

ATE Program Leads to Student Success

Student success is the ultimate goal of the National Science Foundation's Advanced Technological Education (ATE) grants.

Congress's mandate to the National Science Foundation (NSF) in 1992 was to improve technological education primarily through community colleges. Community colleges responded enthusiastically to the challenge with nearly 25 percent of the nation's 1,200 community colleges seeking and receiving at least one ATE grant during the program's first 11 years.

Altogether 547 grants have been made; several community colleges have received more than one grant. There were 238 active grants in February 2004.

A federal program, ATE nevertheless operates at the grassroots level improving how people learn and work. ATE grants fund the "R&D" (research and development) of education programs for technicians who keep the economy,

particularly the high-tech industry, going. They do this by providing community colleges with the capital they need to try new ideas for content and pedagogy in ways that build partnerships with industry, business and other educational institutions.

"We are having a huge impact on technical education in high-tech fields," says Elizabeth Teles, program director for mathematics in NSF's Division of Undergraduate Education.

The educational changes these collaborations instigate affect individual students, but not in isolation. They have national economic implications.

This issue of *TECHcitemen* profiles several students whose lives are better because of the technical skills they learned through ATE-funded projects. Good wages, health

benefits and paid vacations are the most immediate and tangible rewards for many of those who have prepared themselves at community colleges for high-tech workplaces and the education that leads to long term rewarding careers.

"It's like winning the lottery," says Diana Kiesling of her experience in the ATE-funded SpaceTEC program at Brevard Community College in Cocoa, Florida. After working for most of her adult life as an unskilled laborer, Kiesling completed her associate of science degree in 2003 and is working as an aerospace technician at NASA's Kennedy Space Center.

Students, like Kiesling, who take courses in ATE-funded programs learn more than techniques for doing a particular job. They learn how to continue to improve their skills and adapt to future workplace innovations. They have also learned from their instructors, who are immersed in the process of finding the best possible way to educate



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technicians, what it means to continually learn and strive for improvement.

ATE's influence is more subtle, though potentially as significant, for students like those at Columbus East High School in Ohio where an ATE project at Columbus State Community College is contributing to reforms that are raising the high school's graduation rates. Working with members of Columbus State's faculty has made 17-year-old Sophia Howard aware of many career possibilities that will open to her if she continues her education. "I don't know specifically what I'll study. I just know I want a technical field," she says.

The Evaluation Center of Western Michigan University found in its four annual surveys of grant recipients that nearly 274,000 students had been directly affected by the improvements generated by ATE programs. Countless others are benefiting indirectly from ATE as students of secondary school teachers and community college faculty members who have received professional development through an ATE-funded program.

In 2003, ATE projects reported offering 4,381 courses in 523 different programs at 824 locations. The Evaluation Center reported this data in October 2003, noting that 68,450 students were enrolled in at least one ATE-funded course during the preceding 12 months.

ATE is also broadening the definition of scholarship at community colleges. Community colleges with

ATE centers and projects have become *the* places educators and industry professionals go to learn how to prepare technicians to use new technologies.

"We are having a huge impact on technical education in high-tech fields," says Elizabeth Teles, program director for mathematics in NSF's Division of Undergraduate Education. She oversees the ATE program with Gerhard Salinger, program director in NSF's Division of Elementary, Secondary and Informal Education.

ATE's influence is most evident in process technology, information technology, biotechnology, nanotechnology and semiconductor manufacturing. The best practices developed with ATE support have become standard operating procedures among the major employers in these fields.

In the past few years, the ATE program has also supported nascent efforts to organize technician training for emerging fields like cybersecurity, high-performance computing and fuel cell maintenance. Cybersecurity initiatives alone received \$1.7 million in ATE grants during fiscal year 2003 and were expected to receive a similar level of funding in fiscal year 2004. The various ATE efforts to educate technicians for cybersecurity are summarized in a story on page 21.

The innovative teaching styles used by ATE centers and projects are also influencing instructional practices taught to teachers, who begin

their undergraduate studies at community colleges, and community college faculty in nontechnical fields.

The National Peer Review panel of the Engineering Core Curricula, for instance, was impressed by "the revolutionary way of teaching and training students" developed by the South Carolina Advanced Technology Education Center of Excellence (SC ATE). The review panel comprised of scholars and selected by SC ATE for their expertise in a particular subject area, commended the center for fostering collaboration among faculty who organize learning experiences for all types of students. The team was very impressed that teachers from the math, physics, technology and communications areas are working together as a team to help students build the kinds of skills they can transfer to industry.

NSF puts a premium on its grant recipients sharing their experiences with other educators and the public so others can improve their programs. "Very many things have been learned and we don't want them all to remain in your heads," Salinger told grant recipients during a workshop at the 2003 National ATE Principal Investigators Conference. The stakes are high for replicating exemplary technician education throughout the United States: the nation's productivity depends on it. ■

Doing Whatever It Takes for Aquaculture



Gadsden State Community College students get a hands-on lesson from Dan Catchings of the Alabama Division of Wildlife and Freshwater Fisheries in the use of a non-lethal form of electroshocking fish.

Delivering free aquarium fish to Alabama schools is neither glamorous nor intellectually challenging. It is, however, one of the ways that Hugh Hammer stays in touch with the 100 teachers he has trained to use aquatics for hands-on instruction in biology, chemistry, physics, math and business.

The cost of the teachers' workshops and the aquaculture systems he has installed at 27 schools was underwritten by the Advanced Technological Education grant that Gadsden State Community College received from the National Science Foundation.

"In the classroom or lab we focus on the skills this new generation of farmers needs to succeed. Not just math, biology, chemistry, economics; but also plumbing,

diseases or ... troubleshoot chemistry problems," he says.

Tom Summerville uses the tank he received during the Gadsden State program and three others he has added since attending the summer workshop in 2001 to raise tilapia at New Hope High School. As the agriculture-science instructor at the 325-student school in rural northern Alabama, he uses aquaculture to branch out from the traditional shop and agriculture classes. So far, only one of his students has entered an associate degree pre-veterinary science program, but he thinks all of his students have gained a greater sense of responsibility from cultivating the fish.

"It's encouraging their interest in science," he says, adding that many of his students do not like their academic subjects. Maintaining the fish

carpentry, welding. It's a very integrated field," he explains. This is because fish farmers must be good managers of the aquatic environment in their ponds and tanks to achieve cost effectiveness and consistent product quality. "The students need to be able to repair equipment and diagnose and treat

tanks requires students to start the school day with five water tests "that incorporate a good bit of science." He has found that students do not resist this science because it is hands-on. "They're learning science but it's not like me having them sit down with a book."

Terry Youngblood, an agriculture-science teacher at Meek High School in Almy, Ala., finds that a "living laboratory" is a powerful teaching tool. He took his first aquaculture class at Gadsden State nearly a decade ago and helped teach the hydroponics workshop for teachers there in summer 2003. "Some students never see real live animals except dogs and cats," he notes. He established a fish hatchery at Meek High School for students to see fish at every stage of development.

Having the students share the responsibility of feeding the fish, keeping the tanks clean, and recycling the fish water and waste to grow plants makes the science of the nitrogen cycle understandable in a way that is just not possible with drawings on a blackboard. "I want them to actually use my class as a springboard to help them in their other science classes," he says.

Though Youngblood encourages students to pursue aquaculture careers, he says, "Most don't want to leave the community where they grew up." Aquaculture is the fastest growing segment of U.S. agriculture, but in Alabama, most of the fish farmers are in the

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southern part of the state, which is a three-hour drive from Almy. Youngblood, therefore, is starting an aquaponics business at the high school to show students how fish cultivation can be combined with greenhouse production of tomatoes, lettuce, and strawberries.

He has received two local grants to build a greenhouse and plans to sell the produce to local restaurants. Youngblood said he could have just told the students how to become aquaculture entrepreneurs, but he says, "I'd rather show them and have them do it."

Hammer has taken a similar approach in his efforts to build interest in aquascience throughout Alabama. He is using the ATE grant to increase public use of the Aquaculture Education and

Development Center at Gadsden State Community College. With 13 ponds on 40 acres, an indoor hatchery, laboratory, and distance learning-connected classroom, the center is one of nine such facilities in the U.S. located at a two-year college.

"When I accepted the position three years ago, there was very little, if any, activity and/or productivity at the facility. Since that time, I have focused on increasing traffic," Hammer says. Thanks to his high energy level and the extensive industry and government partnerships created as part of the ATE grant process, the center's traffic has increased to more than 1,000 visitors during 2003.

"All of these activities are absolutely free. Some activities were spelled out in the grant proposal.

Others evolved as a natural extension of the proposal to give help to those who wanted or needed it," Hammer says. At the center, Hammer provides tours, field trips, fishing derbies for various youth organizations, fish fries for the community, job shadowing and career information programs.

Most of the high school students Hammer encounters attend school in poor, rural areas. "Kids in these schools don't have ideas or goals beyond high school and this grant helps to open up doors for these kids to pursue a unique and exciting field," he says. ■

For more information see the abstract of Gadsden's ATE grant number DUE 0101714 at www.nsf.gov.

The Bridge to Biotech

John Thomas, 51, had long been curious about the biotechnology company in his San Francisco neighborhood. He even sent the company his resume once; no one replied.

"A few years ago I was homeless," he explains. In the process of changing the factors that led to his homelessness, Thomas "realized that some of the dreams and goals I had when I was young were never really realized so I decided to go back to school."

After enrolling in computer classes at the Community College of San Francisco (CCSF) in 2001, he followed up on a Bridge to Biotech bulletin board advertisement inviting people who are "rusty in math" to attend special tutoring. He took noncredit biotech English and math classes through the Bridge program in spring 2003.

The Bridge program, which is supported by Bio-Link's Advanced Technological Education grant, helps low-income and minority stu-

dents improve their math and science skills. It also exposes them to biotech careers through job shadowing and workplace visits.

"We realized we were putting a lot of effort into recruiting high school students into biotech and that we were leaving out a significant portion of our students who were adults," says Kristin Hershbell, associate dean of grants and resource development at CCSF. The curriculum developed for the Bridge to Biotech provides coordinated

English, math and biotechnology instruction.

Shortly after this was in place, San Francisco Works, the city's job skills training program, asked Bio-Link to help it develop a biotech training program for unemployed people who did not have any occupational training. "They needed skills before the Bridge," Hershbell explains. The partnership created the On-Ramp to Biotech, an eight-week academic and vocational course that places students in internships.

The University of California, San Francisco, which is building a new medical and biotech campus in the Mission Bay section of the city, is now a partner in the collaboration. It hopes the Bridge to Biotech and On-Ramp to Biotech programs will help include the minority, low-income residents who live in the Mission Bay neighborhood in the intellectually challenging and financially rewarding jobs it expects to come with the campus development.

The academic assistance Thomas received in the Bridge program helped him earn "As" in all the math and science courses he has since taken at CCSF. In June 2003, immediately after finishing the Bridge classes, he was placed in an internship at a University of California, San Francisco research lab. In fall 2003 he was hired as a part-time assistant to a university scientist who studies the effect of radiation on colon cancer cells.



John Thomas, a recent alumnus of the City College of San Francisco's biotechnology program, presents at the student and alumni showcase session of the 2003 ATE National Principal Investigators Conference.

While carrying a full load of classes and continuing to work part-time at the lab, Thomas mentors Bridge students out of gratitude for the help he received. He hopes "to land a permanent job" with a biotech company when he completes his bio-manufacturing certificate in spring 2004. He plans to finish his associate degree soon after that.

While Thomas' one-year transition from a person who "knew nothing about biology or the life sciences" to research lab assistant was remarkably quick, he is not the only Bridge student making progress.

"We've had tremendous success to date. We currently have 38 students enrolled in the program from both the Mission and Southeast

areas of San Francisco. We have 88.5 percent retention. We are in our second phase. From the first phase we actually had 95 percent of the [Bridge] students enroll in the biotech program," Hershbell reported at the ATE National Principal Investigators Conference in October 2003.

All 14 of the students in the On-Ramp program in summer 2003 completed the training, and enrolled in the Bridge program.

"It's very exciting," Hershbell says of the 100 percent retention rate. ■

Girls See What They Can Do With Technology at Camp

The jewelry boxes the high school girls make during Bristol Community College's (BCC) program are the snazziest of technology camp crafts.

They also serve as a reminder for the girls of what they can accomplish with technology and high-tech engineering.

The girls cut the aluminum for their individually designed boxes using a computer numeric control machine in BCC's Computer Integrated Manufacturing (CIM) Laboratory Center. The computer numeric control machine is one of several sophisticated tools the girls use during the five-day residential camp the college offers with the University of Massachusetts-Dartmouth.

During the rest of the year the state-of-the-art CIM Laboratory Center is used by students enrolled in BCC's Passport To Success program. The program was created with the support of an Advanced Technological Education (ATE) grant from the National Science Foundation to prepare women, minorities, and non-traditional students to operate the automated systems increasingly used by manufacturing companies. In fall 2003, 125 students were enrolled in Passport To Success.

The ATE grant provided about \$100,000 to equip the CIM Laboratory Center and stimulated collaborations with local industries that provided another \$350,000 to fully outfit it. Industry advisory



High school students design jewelry boxes using Computer Integrated Manufacturing (CIM) through Bristol Community College's Women in Technology summer camp program in Fall River, Massachusetts.

board members have facilitated student recruitment at their workplaces and offered advice to the faculty who developed the Passport To Success curriculum.

"The surviving industries here are either automated or on their way to being automated," says Anthony M. Ucci, an engineering instructor at BCC and principal investigator of the Passport To Success program. "There are very few people actually doing hand work. But there is a growing need for technicians."

About half of the 125 people who have enrolled in the program are employed craftsmen who want to upgrade their skills. Many of the other students are women or members of ethnic minorities seeking new careers. Passport To Success offers two types of associate of science degrees in manufacturing technology and one-year certificates in computer aided design and applied manufacturing technology.

Fall River, Mass., where BCC is located, is economically disadvantaged. The unemployment rate is

often twice that of the more prosperous Boston area. The college's service area is home to many recent Cambodian, Hmong, and Khmer immigrants from Southeast Asia, and Spanish-speaking immigrants from Puerto Rico, Guatemala, and Columbia. Historically, a large number of Portuguese-speaking families from Cape Verde have resided in the coastal communities of southeastern Massachusetts.

While most of these cultures accept women working outside their homes, local traditions have discouraged many of these immigrant women from pursuing postsecondary education.

The five-day camp is just one aspect of the Women in Technology program that BCC offers to raise their career expectations.

The Women in Technology program, which has existed at BCC for nearly 10 years, served as a model for Passport To Success' recruitment efforts. In many respects the two programs overlap with the high school girls who participate in the

Women in Technology programs receiving information about the Passport To Success program. Also, the ATE grant provided supplemental funding to the Women in Technology summer camp in 2003.

The programming offered by Women in Technology also includes a one-day leadership camp each year that is usually attended by 100 young women.

The largest initiative of the Women in Technology program is its Project-Based Learning Process. During the 2003-04 school year, the Project-Based Learning Process placed 60 girls from a consortium of high school tech-prep programs at companies for two days each month to work on "real-life" engineering problems.

A survey of the 201 girls who participated in the Project-Based Learning Process from 1995 through 2002 obtained information from 64 of the 82 who had already graduated from high school. It found that 28 of the recent graduates were enrolled in two-year colleges and 30 were enrolled in baccalaureate institutions. Overall 66 percent of those who reported that they were continuing their education were majoring in engineering or technical fields. Twenty-seven of the girls who participated in the Women in Technology program were BCC students during 2003.

This level of postsecondary activity is quite striking given national data showing female undergraduate enrollment in certain

scientific fields and engineering to remain low.

The National Science Foundation reported in 2003 that only 25 percent of the computer and information science baccalaureate recipients in 1999 and 2000 were female and only 21 percent of engineering baccalaureate recipients were female.¹

Ucci considers the five-day summer camp a "very effective recruitment tool" for BCC's technical and science programs. For this reason, he used \$16,000 of BCC's \$840,000 ATE grant to underwrite the five-day camp in 2003 when its usual funding sources evaporated with state cutbacks and the expiration of other grants.

All of the summer camp's activities are intended to be relevant and memorable to the teenage girls. For instance, on the day the girls learn about structural physics and material testing, they have a lecture in the morning and then build boats sturdy enough to carry at least one girl across the college's swimming pool.

"In the last two years, not one of them has sunk," says Ted Boudria, co-principal investigator of Passport To Success. On the environmental science day the students gather water samples from the Narragansett Bay. The girls practice civil engineering techniques using lasers and transits to survey the campus.

Carissa Kelliher, a mechanical engineering major at BCC, said she was impressed by how excited the

girls were about technical careers and college.

As one of the camp counselors and a former Project-Based Learning Process student, Kelliher encouraged the girls to ask her questions. But she was surprised when one night, after nearly 15 hours of scheduled activities, a group of girls asked her to join them at the end of the hall. "I thought they wanted to talk about boys," she says. Instead, they peppered her with questions about BCC and the college admission process. They wanted to hear about her assignments at Texas Instruments during the three years she was in the Project-Based Learning Process, and most importantly what it was like to go to college.

"They didn't know much about it [college], but they wanted to know," she says. ■

For more information about Passport To Success see www.bristol.mass.edu/CIM or view BCC's abstract of grant number DUE 0101421 at www.nsf.gov.

¹ *Characteristics of Recent Science and Engineering Graduates: 2001*. National Science Foundation. Dec. 2003.

Students Advancing Solutions to Business Problems

The nine Roane State Community College students who took Sam Ruple's Introduction to Programming class in fall 2003 got a bit of a shock. They learned how to write computer program codes while searching for a solution to a problem in a nuclear weapons component inspection process.

"This problem was an absolutely perfect fit to what I needed to cover in this course," Ruple says.

The match of course competencies with real-time business problems is at the heart of the Corporate Scholars Solutions (CSS) program sponsored by the Center for Information Technology Education (CITE) at Nashville State Technical Community College. The CSS program moved out of the pilot stage with Ruple's course and five others at various Tennessee community colleges.

It is the latest in a series of efforts by the Nashville-based partnership of community educators, university researchers, secondary school teachers, and business and industry leaders to infuse problem-solving and contextual learning in technician education.

CITE was funded as an Advanced Technological Education (ATE) regional center in September 2002. Prior to that CASE FILES, an ongoing ATE project led by Principal Investigator James R. Johnson, received funding from the National Science Foundation to disseminate its case studies nationally.

"There are certain things you learn when a problem has never been

solved before," says Sydney Rogers in explaining the desire to go beyond well-written accounts of problems that have been resolved. She is the principal investigator for the CITE grant. She refers to the problems that businesses are sharing with the CSS students as "first generation" and eventually hopes to use them as "second generation" case studies for CASE FILES.

David McNeil, CITE director, says CSS is designed to improve students' understanding of the personal and technical skills they need to work effectively so they will perform better during internships and in their careers.

"It's just not a matter of burying yourself in a cubicle" and coming up with business solutions, he says. So CSS students actually talk with business people about their workplace problems, and then work with other students on teams analyzing the problems, gathering information at the workplace, testing their ideas and then presenting their solutions.

CITE employs similar strategies as it continues to instigate conversations and collaborations between learning scientists, educators and business people. In November 2003, 40 business and education leaders shared their ideas for the best ways to use real-time business problems to improve the preparation of information technology (IT) technicians at a CITE workshop. Plans for IT education reforms will be considered by the 200 people who attend a Synergy 2004 workshop and conference that

CITE is planning with the University of Arkansas-Fort Smith, the National Center for Telecommunications Technologies (NCTT) in Springfield, Mass., and the National Workforce Center for Emerging Technologies (NWCET) in Bellevue, Wash. Participants are expected to consider reforms within the context of business activities, the content of technical skills, and the methods of teaching and learning.

Proponents of the use of real-time business problems, like those used by CSS, contend the authenticity of problems, which are on corporate agendas but are not mission sensitive, improves the quality of the learning experience. Although the weapons inspection problem was resolved before it was presented to CSS students, Ruple said the students' face-to-face meeting with a "client" influenced their learning in a way that reading a case study would not.

"I use case studies and they are excellent. But when you get a real-world problem and you have to make a presentation to the person at the end, it's different," Ruple says. Because security issues prohibited the students from visiting the Y-12 Nuclear Weapons Plant in Oak Ridge, Tenn., a facility supervisor went to Ruple's classroom to explain the need to verify the accuracy of the computerized machines checking the nuclear weapons' components. Manufacturers must follow precise Department of Energy specifications, but moving the components to

properly inspect them often distorts the measurements. He provided the complex technical information as background information, and then left it for the students to figure out how to adjust the machines' programming to eliminate the distortion.

"What do I need to know to solve this problem?" was the first of many questions students had to answer. Ruple then structured all the subsequent classes to cover the material the students needed to learn in their search for solutions. He helped them partition their tasks so they would not seem so overwhelming, but generally acted as program manager, not lecturer, to the student teams.

Ruple explains, "It changed the dynamics of the class to sit down as a design team."

The students' written evaluations were almost unanimously positive about the impact on their thinking.

"I actually learned C language [the programming language], and felt

like I was given an in-depth view of [the] actual job of programmer, and everything I learned pertained to the real world," one student wrote in his evaluation. "The project that was assigned to us was a very good way of giving us experience beyond the classroom," according to another student. "I have also gotten a taste of the 'real world,' how it is to work with a real customer," another replied to the question of what they experienced.

"When you interact with the user, it gets to be very, very real," Ruple says, adding that students want to impress "the customer."

Evaluations for the CSS pilot that worked on a service parts inventory problem provided by carmaker Saturn, and EDS, its IT consultant, during spring 2003, were similarly positive. "This experience was valuable beyond expectations," one student concluded. Another wrote, "Of all the courses I've taken so far, I've learned the most from this one. The

course was fun, informative and exciting."

CITE's business partners were enthusiastic, too. "Students learn not only hard skills such as requirements' gathering, preparing a project estimate and a cost proposal, but soft skills as well as problem-solving and communicating with customers, that have to be experienced in order to be learned," says Dylilah Hill, client delivery executive support leader at EDS.

"I'm very seriously considering the use of some of these out-of-the-box ideas," says Mark Johnson, IT manager for Saturn's service parts operation, after listening to presentations from four student teams. "A couple of these very unique solutions may be used to address this problem or perhaps even some other problems we face." ■

For more information see www.cite-tn.org and www.thecasefiles.org, or view the abstracts of grant numbers DUE 0202249 and DUE 0202397 at www.nsf.gov.

CREATE Recreates Technical Education in California

When Karen Stanton decided to return to college after rearing her four children, she enrolled at the College of the Canyons in Valencia, Calif., because it was close to her home.

"The community college was less scary," she says, explaining, "I didn't have any idea what I wanted to do."

Like many students, Stanton was intrigued and a little intimidated by the cornucopia of careers she could pursue. She had taken physics and math courses 20 years earlier at a four-year college so she thought she might have an aptitude for technical subjects. After completing her first basic computer course, she took a Visual Basic course to

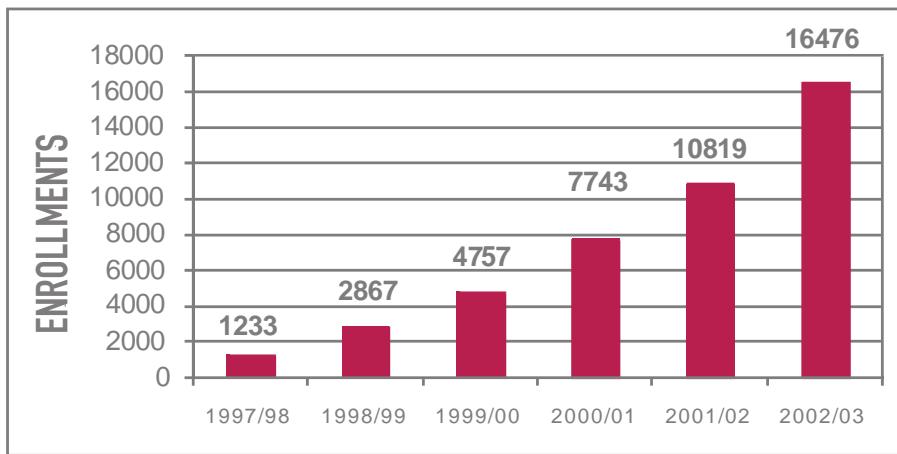
satisfy her curiosity about computer programming.

She eventually decided to major in computer networking not because of the many job opportunities, nor because of the chance to help people. The reason she has an associate degree in computer networking is quite simple: her instructor recruited her.

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Figure 1 Cumulative Enrollment in CREATE Courses



"One of the teachers came and talked to me about that [networking]. And I thought it sounded interesting so I decided to give it a try. I've enjoyed it. It's been extremely challenging," she says.

Stanton is the beneficiary of the profound changes the College of the Canyons and the six other colleges in the California Regional Consortium for Engineering Advances in Technological Education (CREATE) have accomplished in recent years.

Prior to 1997, the seven community colleges had low enrollments in basic electronics courses that just did not mesh with the skills high tech employers sought in their employees. The networking courses Stanton took did not even exist prior to the overhaul of the curriculum that was supported first by a state leadership grant from the California Community College Chancellor and then two ATE proj-

ect grants. Now funded as an ATE regional center, CREATE is concentrating on teacher preparation, high school feeder linkages, articulation and access, student worksite and internship experiences, curriculum development, curriculum delivery and longitudinal evaluation of student success.

The CREATE collaboration between community colleges and industries has resulted in 45 new degree and certificate programs in engineering, manufacturing, electronics and information technology.

"We wanted to make sure we weren't doing little non-credit courses that wouldn't apply to a major," says Kathy Alfano, CREATE center director. The consortium of colleges has developed 140 new courses that integrate academic and technical material.

They also require students to demonstrate competency in skills that match workplace standards.

Students and businesses have responded enthusiastically to the changes. Enrollment has climbed from 1,233 in fall 1997 to 3,808 in fall 2002. Oxnard College's enrollment grew from 40 to 302; Moorpark College's grew from 192 to 1,780. During those six academic years, a total of 16,476 students took CREATE courses at the seven community colleges located in central California and along its coast. (Figure 1).

The growth has occurred despite declines in the computer industry and cuts to state support of community colleges. "The nice thing that has happened with the budget crisis is that we've been able to keep these programs going. Because of the industry support, [college] presidents have been reluctant to cut these programs," Alfano says.

CREATE's work on faculty professional development—the foundation on which the new courses and degree programs are built—continues with the support of the ATE center grant. The center is using Teaching Skills Workshops, the professional development program CREATE developed several years ago, to equip adjunct faculty from industry with the pedagogical skills they need to manage their classrooms well and teach in ways that address their students' different learning styles. Alfano hopes the financial support provided by the ATE center grant will help CREATE "transport" the model beyond the consortium and California.

The center is also addressing the need for its place-bound graduates to continue their educations. It has established a partnership with California State University, Fresno, (CSU Fresno) which brings many of the courses needed for a bachelor's degree in industrial technology to the consortium's campuses. The others are available online. It is also working with California State University, Channel Islands, to develop a new bachelor's degree in information technology.

Since receiving her associate degree in spring 2003, Stanton has

continued to benefit from the center's activities.

She is taking the upper division courses that CSU Fresno is offering at the community colleges. She has also taken the Teaching Skills Workshop to help with her part-time job as a computer lab technician at the College of the Canyons.

Prior to one of her instructor's asking her to be a lab technician, Stanton had not considered assisting other students, and found the idea frightening. Nevertheless, she decided to try it and had a "wonderful" experience. Stanton explains, "It gave

me the chance to understand the material that much more. When you have to explain it to someone else, you learn so much better yourself."

Now Stanton is thinking of becoming a teacher; a career path that Alfano is encouraging. She thinks Stanton would be a great community college instructor. ■

For more information see www.create-california.org or view the abstract of grant number DUE 0202396 at www.nsf.gov.

FaST Puts Community College Faculty, Students to Work in National Research Laboratories

"What did you do last summer?" prompts confident, detailed responses from three Austin Community College (ACC) students in Austin, Texas, who participated on a Faculty and Student Team (FaST). The challenge for the listener is to comprehend the complexity of their answers.

Aaron Ramirez studied how subsurface microorganisms use organic compounds to get energy in a process known as electron shuttling. Synthetic electron shuttling is a potential method for the biotransformation of uranium to reduce groundwater contamination.

Maria Jimenez studied the filamentous fungi isolated from geothermal sites in Russia. She subjected the fungi to whole-cell fatty acid methyl ester analysis using gas chromatography.

Scientists hope this sort of analysis will lead to better charac-

It was "an unbelievable amount of work," Maria Jimenez says of her FaST internship. However, she has no regrets. "It's hard, but you make do. You take the initiative and you do it."

terization of the microorganisms to new chemicals for biotechnology.

Cristina Ramirez, no relation to Aaron, attempted to develop a more efficient method for identifying bacteria with crystalline protein surface layers or S-layers. For her experiments, Ramirez designed protocols using chemicals and enzymes to remove the S-layers. Her results could have implications for semiconductor manufacturing and nanotechnology.

Their internships and the research of Larry Britton, the ACC faculty member who accompanied them to the Lawrence Berkeley

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Aaron Ramirez comments on his FaST experience, "I am very thankful to have been part of this group. The mentors have opened up their labs and projects to us and I have learned a lot from their sharing."

National Laboratory (LBNL) in Berkeley, Calif., are literally the stuff of professional journals and national conference presentations.

The Faculty and Student Team (FaST) program, which paid the students' stipends and Britton's salary during summer 2003, is a partnership between the Department of Energy (DOE) Office of Science, which funds energy research at the national labs, and the National Science Foundation (NSF). NSF has other programs aimed at increasing the number of people pursuing careers in math, science and engineering. Among them is the Advanced Technological Education program (ATE), which tries to accomplish this goal by improving technician education. Separate from the FaST program, several ATE projects also place students in summer internships at DOE labs.

Linnea Fletcher, coordinator of the biotechnology program at Austin Community College, says she applied for the FaST program as an extension of her ATE grant because she wanted her students to test their skills and learn in the intense setting of a high-profile lab with state-of-the-art equipment.

"I wanted more demands on them. I wanted them to see who

they will be competing with," she says. Fletcher pointed out that having Britton go along made the experience better for the student interns, enriched him professionally, and benefited the students he has taught since returning.

Initially, the three ACC students were tentative and a bit anxious about how they would blend with the professional staff and the 85 other interns at the lab during the summer of 2003. "To get in a real research environment and to get in a higher level of research, it's a real eye opener," says Britton, a microbial physiologist and senior research scientist at the University of Texas (UT). He likes teaching community college students so in addition to his UT research he is an adjunct biotech instructor at ACC.

As the students talked with more people at the Berkeley lab and got to work using the skills they had learned in their ACC biotechnology courses, they realized that they already knew quite a bit and could meet the lab personnel's high expectations. "You could just see the confidence in them going sky high," Britton says.

Others noticed their skills too. "These three kids have very, very terrific attitudes to other people, to the lab," says microbiologist, Tamas Torok, staff scientist with the Center for Environmental Biotechnology at LBNL.

Torok served as the main mentor for all three of the ACC students. Each of them also worked directly with a staff scientist at the laboratory, which is affiliated with the University of California, Berkeley.



"I explained to the students what to do and they did it," Torok comments, adding, "Their work is very reliable."

The three so quickly became "very valuable colleagues" that Torok and others at the national

laboratory urged them to apply for Student Undergraduate Laboratory Internships (SULI), another DOE program that pays students to work in national labs for up to 16 weeks. SULI pays students a stipend and covers room and board.

“Sometime in the summer a couple of conversations took place and [it] became clear that the [ACC] students would be interested in coming back for the fall. We all thought it would be a great idea and worked to make it happen,” explains Laurel Egenberger of the lab’s Center for Science and Engineering Education. The center coordinates intern safety training and activities like a weekly “brown bag” lunch seminar where the students hear about different research or learn about careers in science.

“Summer students are usually not able to stay in the fall, but we do invite all especially successful students to stay on or come back.” Egenberger continues, “We were delighted that we could have the whole student team.” Because the ACC students wanted to complete their associate degrees in biotechnology with their classmates, they took online courses during the fall while living in a UC-Berkeley dormitory and working full-time at the lab.

They had different research projects than in the summer. In the

In addition to the FaST and SULI programs, the U.S. Department of Energy’s Office of Science has internship opportunities exclusively for community college students. The Community College Institute offers community college students paid, summer internships at six national laboratories.

fall, Aaron Ramirez looked for hyperthermophilic bacteria in soil samples that Torok had collected at Lake Baikal and the Kamchatka peninsula in Russia. He worked with a visiting scientist from the Ukraine to monitor the bacteria in an intensely hot, oxygen-free incubator. Cristina Ramirez switched to the fatty acid analysis. Jimenez learned how to use DNA extraction techniques to characterize the genetic sequence of organisms.

Aaron Ramirez was relieved he could hold his own with the baccalaureate students he encountered during his internships. “While talking shop, I could not only understand what they were telling me, I was able to share a few ‘Did you know this?’” he says.

Interning in the national lab has cemented all three students’ plans to pursue baccalaureate degrees in science. They think the

internships will help them get higher-paying biotech jobs when they finish their associate degrees; all three plan to work as technicians while they complete their junior and senior years of coursework.

Britton, too, found the experience at the Berkeley lab extremely beneficial. As a senior scientist at the University of Texas Center for Petroleum and Geosystems Engineering, Britton describes himself as a “lab rat. I love to do research.” For him, conducting experiments and analyzing data at the national lab was a rich professional development opportunity. “The experience of working in a national lab allows you to get more than from perusing journals,” he says. He particularly liked learning about scientific advances a year or two before they are widely disseminated, and he feels that his work there puts him ahead of the mainstream in his profession.

He and Torok plan to continue collaborating and have applied for grants to support their joint research. Britton comments, “When you go and do these things, you go and do it with the idea that it’s going to lead to other things.” ■

For more information about Department of Energy programs see www.scied.science.doe.gov.

ATE Grant Reaches Hearing-Impaired Professionals

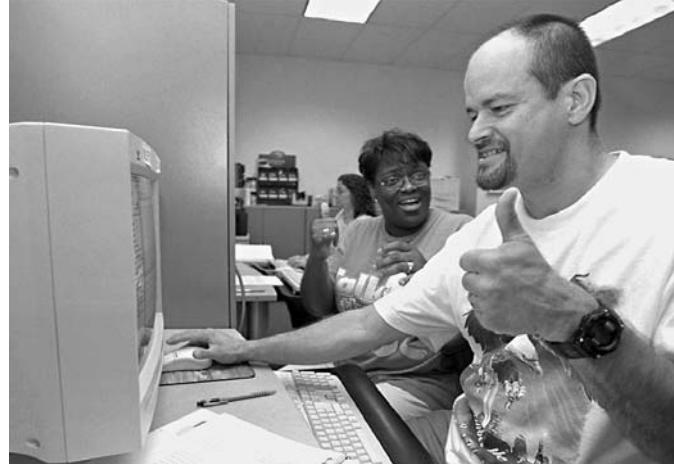
A deaf professional trying to update his or her skills in a class where all the other students can hear the instructor, who frequently turns to face a computer monitor, is like a foreigner in a foreign land.

"There is always a lag time with what the instructor is saying and with what the interpreter is interpreting. So, you are always a minute or two behind the class. You are not laughing when the class laughs. You are always asking questions at a different time than [others]. The class is always a little ahead of you," explains Donna Lange, assistant professor of applied computer technology at the National Technical Institute for the Deaf (NTID).

NTID serves 1,100 deaf and hearing-impaired undergraduates on the campus of the Rochester Institute of Technology in Rochester, New York.

NTID's Applied Computer Technology Department has received two Advanced Technological Education (ATE) grants to address the needs of deaf and hearing-impaired professionals with week-long workshops on topics like web applications, networking and multimedia programming.

"With these workshops, every one in the class is deaf. And the teacher is deaf or knows sign language. So there is direct communication," Lange says. "It's all in direct sign language."



Deaf information technology professionals attend a workshop at the National Institute for the Deaf at the Rochester Institute of Technology in Rochester, New York.

In addition to the direct instruction, the working adults have the additional benefit of networking with professional people who face similar workplace challenges. During the first grant from 2000 to 2003, 145 people attended one of the 20 workshops.

Jim Johnson, who attended a Windows server workshop, wrote to NTID that he used his new skills in his job almost immediately. "We had a security situation come up at work, and some of our servers were affected. They had to be replaced in a hurry, and, with one of my technicians out sick, I was able to help build the domain server. Never thought I would use my new skills from the workshop this soon. I guess I took a few folks by surprise! Thanks again for a great class," he wrote in an email.

The grants from the National Science Foundation help keep the

cost of the five-day workshops at a relatively inexpensive \$300.

The first grant equipped a new, 13-workstation computer lab for the workshops; the second provides for upgrades to the equipment and computer software.

Perhaps the most important aspect of the grant is the release time and professional development money it provides for the 10 members of the Applied Computer Technology

Department faculty. Both grants cover the salaries of the faculty members during their 10-week leaves and provide up to \$3,000 for professional development expenses. During the first grant, NTID hired a visiting professor to replace the one faculty member who was relieved of teaching responsibilities each quarter. A similar rotation is planned during the second grant.

"One of the big benefits has been a huge morale booster in the department. Because every department member is involved in the project, everybody gets a leave; everybody is meeting deaf professionals. It's a lot different when you are teaching adults that want to learn," Lange says, describing the faculty as "amazingly motivated for this project."

The experience of David Lawrence, an instructor who wanted to find out more about wireless

technologies, is typical. During the quarter he did not teach, Lawrence took a 10-week course on wireless technologies and attended a couple of professional conferences to improve his understanding of advances in this field. He plans to take the Cisco test to become a Wireless Certified Professional. In addition to developing the curriculum for the workshop on Wireless Networks and Mobile Communica-

tions, he used what he learned during his leave to develop a new wireless technologies course for NTID's associate degree students.

In all, the grant has helped the institute create five new courses and modify six others.

During the second grant, NTID hopes to establish a national clientele among individual deaf professionals and corporations to allow the workshops to become self-

sustaining when the grant funding ends. NTID is also working with other community colleges to offer the IT workshops for deaf people who cannot make the trip to upstate New York. ■

For more information see www.rit.edu/diit or view the abstract of grant number DUE 0302790 at www.nsf.gov.

Clever Blend of Old and New

The Forest and Wood Products Institute at Mount Wachusett Community College in Gardner, Massachusetts is cleverly blending old and new media to reach rural students and others interested in woodworking.

The institute is collaborating with *Wood Digest Magazine* to provide college-level wood technology courses.

Between fall 2002 and fall 2004, the monthly magazine with 51,000 subscribers will publish the content of two three-credit courses: Wood Structure and Properties, and Wood Machining Technology.

Readers who want to extend their learning beyond a casual reading may register with the college and pay \$478 per course plus the cost of books. The rolling enrollment process allows students to register anytime during the 12-month peri-

od that each class is offered.

Registered students receive a password to access additional information, complete homework, take exams, participate in group discussions and submit a paper using the college's distance learning system. Twenty-three students completed Wood Structure and Properties during 2002-03. During fall 2003, 15 students took Wood Machining Technology; three were enrolled in Wood Structure and Properties, and 10 took Forest Ecology and Silviculture.

"The class informed me on several different areas that have helped me in my understanding of our products and the possible problems different defects and wood may cause. I feel that your class has made me better at my job," Jeffrey Anderson, a mill manager at an Independent Stave Company sub-

sidiary in New Florence, Missouri, wrote in an email after completing the Wood Machining Technology course. He recommended the course to several co-workers who subsequently enrolled.

A woman who works at a company that makes composite wood products, replied to a question on the institute's electronic bulletin board that she took the course because "I wanted to learn more about all the 'real' woods even though I haven't had much opportunity to work with them in the last several years. There is always the possibility that I would someday again be involved in the 'real' woods and I knew there was much to learn. I knew, too, this course would be a real challenge for me and I'm enjoying it."

"Prior to going online, these

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courses had few students in the classroom. Now I reach a larger audience and help the woodworking businesses in a manner that is cost effective to the business and time effective for the student," says Ken Hanson, workforce development coordinator, college instructor, and principal investigator for the project. His ATE grant covers the cost of writing the articles, getting

them printed in the magazine and placing the material online.

Wood Digest is publishing the two-page spread of course material for \$1,000 per month rather than its customary ad rate of \$5,500 per page as its contribution to the project, according to Steve Ehle, editor-in-chief of *Wood Digest*.

"The idea is to educate people," says Ehle, who sees the response as

consistently positive even from readers who do not formally enroll in the courses. Ehle comments, "As long as people are reading it and getting something from it, it's OK with me." ■

For more information see <http://wood.mwcc.edu> or view the abstract of grant number DUE 0202345 at www.nsf.org.

Faculty Development Base for Engineering Technology Core Curriculum

One of Wade Carrick's favorite things about attending Florence-Darlington Technical College is the Engineering Technology Core (ET Core) curriculum.

When he learns a formula in math, he deciphers it in physics, writes about it in English, graphs it in computer science, and applies it in electronics. At many points during the day, the formula is connected to work-based problems he and his fellow students are asked to solve in teams.

"I love the integrated curriculum," Carrick says, adding, "It's very well-rounded."

The ET Core, as the integrated curriculum is known, is the result of years of work by the South Carolina Advanced Technological Education Center of Excellence (SC ATE). Its

local goal is to graduate well-rounded technicians. As an ATE Resource Center for Engineering Technology, SC ATE's national goal is to increase the quantity, quality and diversity of engineering technology students. Its new Fast Track program is developing strategies to improve recruitment, retention and on-time degree completion.

The innovative ET Core that is SC ATE's hallmark, and which Carrick took in 2003-04, began with faculty development in the early 1990s, according to Elaine Craft, director of the center based at Florence-Darlington Technical College. "We had to have the faculty buy in from day one," she says.

Faculty teams from each of South Carolina's 16 technical colleges received training on contextual learning and education theory, along

with practical methods for dealing with multiple learning styles and students of different ages, genders, races, and ethnicities. "The goal was to build a cadre of reform-ready faculty," she explains.

These educator teams were then encouraged to think about how the competencies of the various technical fields could be taught more effectively. The result of these team efforts—with support from research by the center's staff and advice from industry—is the interdisciplinary, problem-based curriculum.

Four South Carolina technical colleges use the ET Core and the Technology Gateway, which the center developed with ATE funding, to help under-prepared students improve their skills. Two South Carolina colleges use just the Technology Gateway.

The curricula have been adapted by colleges in Texas, Connecticut, and Kentucky. It is also the subject of ongoing faculty development efforts by the center.

"You can't ever quit working with faculty," Craft says.

Quantitative and qualitative data indicate SC ATE's innovations are making a difference in students' lives.

The Academy of Educational Development (AED) reported in 2002 that the ET Core has increased ET graduation rates by over 300 percent among students who persist to the second year or third semester of the program. It compared the number of graduates from 1998-99, the first year the ET Core was implemented, through 2001-2002 with the performance of students enrolled in the associate degree engineering program from 1992 through 1994. AED's evaluation team found that by the end of three years, 34.4 percent of (43 of the 125) students completed the second year of the engineering technology courses and graduated, compared to the traditional ET graduation rate average of 10 percent (among 1,614 traditional ET students in 1992, 1993, 1994) after three years.

AED concluded the curriculum "has provided a sounder foundation for, and increases student success in the second year ET courses."¹

Student stories are also impressive.

Only one year of Walter Allen Robbins' engineering technology degree courses at Tri-County Technical College followed the ATE

model, but the lessons have had a lasting effect on his career and personal life. Robbins said he liked the integrated curriculum because, "it takes everything and brings it into one big picture."

His grammar and spelling improved, thanks to the requirement that students use proper English in all of their assignments. "In the business world, I learned very quickly that you can't communicate if someone reading your writing says you don't know how to spell," he says.

The physics classes still inspire his dream—so far delayed by full-time work and family responsibilities—to get a four-year degree in engineering. But the ATE teamwork has stayed with him. Allen went to Tri-County Technical College in 1999 with seven other apprentices from the Robert Bosch Corp. For a year they had to do their ATE teamwork assignments together.

"We ended up functioning like a team," Robbins says. The eight are still close, meeting socially for little reunions. All of them still work as production technicians at Bosch, though not together. However, they have all progressed in their careers with each other's help. Whenever new equipment arrives or one of them feels the need for a skills upgrade, they hold a study group meeting.

Camaraderie in the workplace has not come as easily for Pamela Brown. She attended Piedmont Technical College on her own, squeezing in night and day courses.

Finding the balance between the required sequence of ATE courses, work, and the needs of her husband and three children was difficult, but she has found that her efforts were worthwhile. "I tell you if it hadn't been for the family and the kids helping me through I wouldn't have made it," she says.

Less than a year after receiving her associate degree in December 2002, Brown moved from the second shift to the first at Timken Company. Her hourly wages as an electrical and mechanical maintenance technician are double what she made installing sheetrock, her previous occupation. She has health benefits and paid vacation for the first time in her life.

"The work's not hard. The hard thing is to get the men to accept that I can do the job," Brown says of the cultural obstacles she has overcome. "I'm the only mechanical maintenance woman to ever work at this plant," she says, pointing out that it has existed for 40 years.

It took some time, but Brown said most of the men's attitudes changed when they saw that she was not afraid to get on the machinery and that she could fix it. "Now, I'm one of the boys," she laughs. ■

For more information about the SC ATE Center of Excellence see www.scate.org, or view SC ATE's abstracts of grant numbers DUE 0202272, 0242550, 0302713 at www.nsf.gov.

¹ *Reforming Engineering Technology Education: Sixth Year Evaluation of the South Carolina Center for Advanced Technological Education*. Academy for Educational Development. Aug. 2002.

SpaceTEC

Diana Kiesling took her eight-year-old granddaughter, Heather, with her to Brevard Community College when she needed to buy books for her SpaceTEC classes.

"It's a good role model for them to have someone in their immediate family going to school; to see it can be done with a little perseverance," Kiesling says, referring to Heather and three other grandchildren.

The grandchildren, along with Kiesling's husband and adult daughters, share her excitement about obtaining an associate in applied science degree—the family's first college degree—and her work at the Kennedy Space Center. She began working there in January 2003 as a paid co-op student, while taking SpaceTEC classes at Brevard Community College.

SpaceTEC is the national Aerospace Technical Education Center based at Brevard Community College in Cocoa, Fla., and is supported with an Advanced Technological Education grant. SpaceTEC is developing a national aerospace technician education program with community colleges in eight states. All of the partners are located adjacent to NASA Field Centers or Department of Defense facilities.

NASA and its aerospace contractors, like other industries that have depended on highly skilled, experienced workers expect to lose

thousands of veteran technicians to retirements.

As Kiesling talked outside the Vehicle Assembly Building at the Kennedy Space Center, she still seemed in awe about working inside the mammoth building she had seen from a distance most of her 47 years. It never occurred to her that she could work at the NASA facility, or even that she could go to college, until her friend suggested she enroll in SpaceTEC's training.

"I never thought I would go back to school. It just wasn't in my future," she says.

Kiesling and her friend, Mark Davis, worked together at a small manufacturing company until he was laid off during the economic slowdown that followed the September 11 terrorist attacks. "When you are in manufacturing companies, the jobs tend to swell and shrink, so there are periodic layoffs," Kiesling says. She was laid off a few months later.

It was then that Davis told her about a state program to retrain displaced workers. The program was paying for his tuition and books for the two-year SpaceTEC program. It sounded interesting to Kiesling, but she had many concerns, not the least of which was her age.

"I asked my friend if I'm too old for this program and he laughed at me," Kiesling says. He also told her how to register for classes and where to buy her

books. "He kind of mentored me through the whole process."

Her anxiety about taking algebra, English and science subsided after she settled into good study habits and got through her first tests. She liked structural fabrication and other hands-on courses best.

"The courses were very applicable to what we do here," Kiesling says of her co-op assignment inspecting the Shuttle's components, hardware and electrical systems. She has found that the emphasis on accurate performance matches the priorities at the Kennedy Space Center. "They want to make sure the job is done right. People's lives depend on this. They are very cautious and very careful," she explains.

The sense of being part of the nation's space team certainly inspires Kiesling. But it is the combination of a tuition-free college education and the likelihood that she will make \$20 per hour in her first full-time aerospace job that has made SpaceTEC a transformative experience for her.

"It's like winning the lottery," she says. ■

For more information about SpaceTEC see www.spacetec.org, or view an abstract of SpaceTEC's grant number DUE 0202398 at www.nsf.gov.

Robotics Team Inspires Young Women and Minorities to Excel in Math and Science

The students on Bahig Michaels' Newark Technical High School robotics team are so diverse—a dozen different ethnic groups are represented on this year's team—that he proudly calls them "a mini United Nations."

Michaels, who until recently was the physics teacher at the inner city magnet school, started the robotics team in 2001 after attending the Building for Tomorrow training offered by the New Jersey Center for Advanced Technological Education (NJCATE) at Middlesex Community College in Edison, New Jersey.

Building for Tomorrow is predicated on the hope that participation in robotics teams or in other academic competitions will spark student interest in math, science, engineering and technology careers. The urban high school teachers who attend the Building for Tomorrow week-long, summer institutes learn team-building skills, organizational strategies, and fundraising techniques. NJCATE's ATE grant also provides \$800 in materials for the teachers to use with their student teams.

The combination of group activities and skill challenges provided a successful formula for attracting a "significant female presence" on Woodbridge High School's robotics team, according to Teacher Jim West.

"The greatest thing about the robotics team was that it was so versatile. It allowed for any person to participate, not just a techie,"

explained Komal Ahuja, a former member of the Woodbridge team who attends Stevens Institute of Technology in Hoboken, New Jersey.

Ahuja's choice of a career in science was influenced by her robotics team experience. "We were thinking in a manner that exemplified the scientific model. We came up with theories and we ultimately put them to the test. The experiments were self-designed. Our structured thought processes, the strict dedication to a presented task, and the clean execution of the game plan made us scientists," she says.

Meghan Howard, a 2004 senior at Woodbridge, said the robotics team let her explore a field she otherwise would not have considered. Because of her experience on the team during her sophomore year, Howard took an introductory computer science course as a junior and an Advanced Placement computer science course her senior year. "It was a great experience that offered a taste of technology in a fun environment," she says.

In Newark, Bahig Michaels uses robotics as a catalyst for tying physics, computer technology and math together, and for boosting student confidence. Sixteen of his former robotics team members now attend the New Jersey Institute of Technology (NJIT). Another

is attending Rensselaer Polytechnic Institute. Eight of the 24 students on the 2003-04 team are girls and several of them were accepted early to NJIT. Before the robotics team existed, few of Newark Technical High School graduates went directly to any college.

Most of the team members, who come from blue-collar working families, were not particularly motivated in math or science when they started high school. "Robotics anchored science and math for them," Michaels says. The requirement that students maintain a 3.2 grade point average (G.P.A.) to participate on the team has been an incentive for students to improve their study habits, which has pushed the team's average G.P.A. to 3.5.

Newark School Superintendent Marian Bolden was so impressed with students' excitement about math and science and the success of

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Students from Newark Technical High School in Newark, New Jersey demonstrate their robot at the 2003 ATE National Principals Investigators Conference.

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Michaels' teams—they have won several prestigious national awards in the For Inspiration and Recognition of Science and Technology Robotics Competition—that in 2003 she made him the district's first full-time robotics coordinator. He now over-

sees 10 robotics teams in Newark high schools and 15 FIRST LEGO League teams, which are robot competitions for middle and elementary school students. He also directs efforts to develop teams in many of the district's 55 other schools.

Michaels likes to see the

Newark students excel at their various competitions, but he says, "It's not about winning. It's about inspiring them." ■

For more information see www.njcate.org or view the abstracts of NJCATE's grant numbers DUE 0101568 and 0302757 at www.nsf.gov.

WGBH Offers Customizable Recruitment Materials

WGBH's *Pathways to Technology* makes the work of top-notch documentary filmmakers available at no cost to community colleges for their recruitment efforts.

"It's exciting that colleges can take this [online video] and can stream it on their own Web sites to customize the message," says Thea Sahr, senior outreach coordinator with WGBH, the public television station in Boston. "We have tried to be a really fabulous junior staff member who does the thinking for you," she says of the educational production team.

The WGBH Educational Foundation received an Advanced Technological Education (ATE) grant from the National Science Foundation (NSF) to showcase innovative technician education programs at community colleges that NSF supports with ATE grants.

Instead of aiming for a mass television audience, *Pathways to Technology* uses various media and

hands-on activities to pique individual viewer interest in emerging technologies while highlighting the advantages of attending a community college.

By featuring instructors, students and graduates of ATE projects and centers, the multi-media program focuses on career opportunities in biotechnology, information technology, marine science, precision agriculture and process technology. Profiles of successful community college graduates illustrate the jobs available in these new fields and the skills needed to attain employment.

Although the programming highlights students from ATE programs, *Pathways to Technology* online videos, CD-ROM and VHS videos are highly usable in many situations.

"We really tried hard so these would resemble Anywhere, U.S.A.," Sahr says.

WGBH certainly hopes to reach everywhere U.S.A. The

station's outreach department sent 67,000 promotional brochures to high school guidance counselors, community college faculty, and administrators when the program was released in 2003. The producers hope it will be used by guidance counselors to spark student interest in technical careers and by community college personnel to inform their many constituents about what is available on their campuses.

The *Pathways* Web site (www.pathwaystotechnology.org) is aimed at people considering technical careers. It not only provides information about new high-tech careers; its database allows users to search for community college contact information by state or zip code. Typing in a zip code on the Web site immediately generates a list of the community colleges located within 100 kilometers of that zip code.

The *Pathways* CD-ROM entitled "Recruitment Tool Kit" was

distributed to all 1,200 community colleges by the American Association of Community Colleges (AACC) to raise awareness

pathways to technology

among college administrators and faculty of the availability of these free resources.

All three formats, CD-ROM, VHS, and Web site—use identical information gathered by WGBH during filming at community colleges in 2002. “It’s just cut a little differently,” Sahr says.

Pathways producers also developed activities that community

college recruiters can use at college fairs and conferences, or in presentations to small and large groups. WGBH and AACC are testing the effectiveness of the multi-media program and activities at 16

community colleges.

One hands-on activity shatters stereotypes about community college students. Another connects community college degree programs with cutting-edge industries.

The third addresses student anxieties about the difficulty of the math and science courses necessary to gain entry into high-tech fields. This “Keys to Cool Careers” Power

Point presentation uses vignettes of three students: a math phobic student, a middle-aged student with rusty math skills, and a teenaged math whiz. It shows that high-level courses are “not so scary but very necessary,” Sahr says.

“The message is that no matter where you fit on this spectrum, the local community college can help you.” ■

For more information see www.pathwaystotechnology.org or view the abstract of WGBH's grant number DUE 0202223 at www.nsf.gov.

Cybersecurity Programs at Community Colleges

There was a time, not so long ago, when criminal justice and information technology (IT) courses did not overlap at most community colleges.

“Now law enforcement must be familiar with computer security,” says Robert Campbell, vice president of information technology at Rock Valley College in Rockford, Ill. Conversely, computer systems administrators and computer technicians must be prepared to support forensics activities that preserve and analyze the magnetically encoded information in computers.

The community college response

to the increasing demand for IT security professions must first overcome the scarcity of faculty resources. “One of the big challenges is getting faculty who have the expertise to teach this content,” Campbell says.

The National Science Foundation (NSF) is using Advanced Technological Education (ATE) grants to help community colleges address this faculty development challenge and the national need for cybersecurity-savvy technicians. These grants are also assisting cybersecurity collaborations among community colleges, and between community colleges and universities.

In the 2003 fiscal year, which began in October 2002, \$1.7 million in ATE grants went to cybersecurity projects, according to R. Corby Hovis, the program officer who oversees these ATE-funded cybersecurity initiatives. He estimates that four additional grants will be awarded and a similar amount of money will be dispersed for cybersecurity through the ATE program during fiscal year 2004.

Hovis pointed out that NSF's leadership in cybersecurity follows methods that have worked well to shape consensus in the past when

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new fields, like nanotechnology, emerged in science, engineering and technology. The agency generally begins by supporting efforts to bring researchers from various disciplines together to consider the breakthrough or, in the case of cybersecurity, the need for new initiatives. It then offers incentives in the form of grants that encourage research.

Following the terrorist attacks on September 11, 2001, NSF responded to concerns about community colleges' role in national cybersecurity efforts by supporting a workshop convened by the American Association of Community Colleges (AACC). In the past, most federal support for cybersecurity went toward beefing up university research centers. In June 2002, with funding from its ATE dissemination grant, AACC brought industry and government cybersecurity experts together with community college and university educators.

Hovis said that a key result of this meeting was the now widespread recognition that community colleges train the technicians who are the front line defenders of all types of information technology systems against viruses, hackers and other subterfuge. The meeting identified

good community college cybersecurity programs and educational materials. Community college educators also learned what universities and cybersecurity professionals expect from community college-trained technicians.

"If we hadn't had the meeting we would be getting a lot of questions and still not have many ideas about where [people] should get cybersecurity training," he says.

Hovis says NSF's expectation is that the cybersecurity projects it has funded through ATE will begin having regional and national impact. He hopes other community colleges will use ATE-developed curricula and materials rather than try to build their programs from scratch. "We really like to see the education materials and practices adopted by other institutions and adapted for their needs," he says.

Adoption and adaptation are already evident in many of the ATE-supported cybersecurity initiatives.

Cal Poly Pomona, which has had information assurance courses since 1980, is working with **Mount San Antonio College** (Mt. SAC) in Walnut, Calif., on the community college's new information systems security curriculum and Regional Information Systems Security Center. Mt. SAC is using its ATE grant to develop an associate of science degree in network security. New networking classes will begin in fall 2004 with courses in security auditing, information systems security, and security management to follow.

"The grant has focused 33 percent of Mt. SAC's Computer Information Systems Department on the development of cybersecurity education," Professor John Blyzka says. He is the principal investigator of Mt. SAC's ATE grant (DUE 0302942). In addition to sending faculty to special cybersecurity events, the college is setting aside facilities for new classroom labs that will be ready in spring 2005 to accommodate the new courses.

Del Mar College in Corpus Christi, Tex., is leading regional efforts to build the information security workforce in Texas with its ATE grant (DUE 0302734). The grant supports professional development of faculty and their efforts to produce the curriculum for new associate in applied science degrees in systems security and forensics. The first new degree courses begin in spring 2004.

"The project will produce students to meet industry's need for IT workers with security skills in the following areas: application, integration, system monitoring, forensic analysis, deterrence, disaster recovery and user education," summarizes Larry Lee, chairman of the Computer Science Department at Del Mar.

The college's long-term goals are to produce computer-based interactive modules that standardize learning outcomes, to develop tiered instruction that can be replicated at other community colleges, to devise articulated career pathways that take high school students to community colleges and on to four-year institu-

tions, and to create a teacher training model that can be used at community colleges and secondary schools.

Moraine Valley Community College (MVCC) is using its ATE grant (DUE 0302612) to create a Regional Center for the Advancement of Systems Security and Information Assurance at its Palos Hills, Ill., campus. It is coordinating efforts in the Midwest to develop AAS and BS degree curriculum in IT security and data assurance. The partner institutions want the curriculum to be standardized, skill-based, vendor-neutral and replicable. The regional center will also offer community workshops to increase public awareness of computer information security issues.

In spring 2004, the center will hold training labs for the partner colleges' faculty. Summer faculty workshops are planned for other community college faculty, according to Erich Spengler, associate professor of computer-integrated technologies at MVCC and principal investigator of the ATE grant.

The National Workforce Center for Emerging Technologies (NWCET) at **Bellevue Community College**, Bellevue, Wash., has developed skill standards for cybersecurity with a supplement to its ATE grant for disseminating IT skills standards. The cybersecurity standards are available on the NWCET Web site, www.nwcet.org, and are included in the 2003 edition of *Building A Foundation for Tomorrow: Skill Standards for Information Technology*.

"We have strongly advocated for

the community college role both in preparing new IT professionals with cybersecurity skills, and in making sure existing IT workers have cybersecurity skills," Peter Saflund, NWCET associate director says.

Another NWCET grant (DUE 0101657) added a cybersecurity component to the Working Connections Faculty Development Institute. Co-sponsored by AACC and Microsoft, NWCET plans to deliver incentive-based, cybersecurity training in a partnership with CompTIA to community college instructors in the nation's IT intensive regions.

Norwalk Community College (NCC) in Norwalk, Conn., developed an accredited degree program in computer security and data assurance and is among the programs that have been assisted by NWCET's skill standards. NCC is using part of its ATE grant (DUE 0201873) to cover the cost of security industry courses for faculty who will teach the new courses. For instance, NCC plans to add a computer forensics course in summer 2004 when an instructor completes an externship with the Connecticut State Computer Forensics Police Lab team.

Barbara Belton, director of the Center for IT at NCC, finds it "very exciting to be able to see my faculty expand their skill sets and knowledge base—and know that the students and community are beneficiaries."

Also in Connecticut, **Western Connecticut State University** in Danbury received an ATE planning

grant (DUE 0302779) to develop a New England Regional Center for Information Systems Security (ISS). With the grant it will conduct a comprehensive workforce assessment of the ISS needs in the region and enhance two pilot efforts to improve the ISS career path between secondary schools and post-secondary institutions.

An ATE planning grant has supported the work of six Washington, D.C. area community colleges to determine the feasibility of a cybersecurity regional center in the metropolitan area. This effort is being led by **Prince George's Community College** in Largo, Maryland and has tentatively been named CyberWATCH for Cybersecurity: Washington Area Training for Cybersecurity Headquarters (DUE 0302751). Faculty workshops and meetings with potential university, corporate and government partners have been held to prepare the regional center proposal.

Several ATE regional centers and their partner colleges have incorporated cybersecurity in their course offerings using their existing ATE grants. Among them are iTEC, the Information Technology Center in Florida at Daytona Beach and Seminole Community Colleges; the National Center for Telecommunications Technology at Springfield Community College, Mass.; the regional IT center at the Kentucky Community and Technical College System (KCTCS); and Contra Costa College, Calif. ■

TECHcitements

ATE Centers

ATE National/ Resource Centers

American Chemical Society (DC)
Bellevue CC (WA)
Brevard CC (FL)
Chemeketa CC (OR)
College of the Mainland (TX)
Daytona Beach CC and Seminole CC (FL)
Eastern Iowa CC District (IA)
Iowa State University (IA)
Kirkwood CC (IA)
Maricopa CC District (AZ)
Maui CC (HI)
Middlesex County College (NJ)
Monterey Peninsula College (CA)
San Francisco CC District (CA)
Sinclair CC (OH)
S.C. Technical College System (SC)
Springfield Technical CC (MA)

ATE Regional Centers

AIM Institute (NE)
College of the Canyons (CA)
CC of Baltimore County (MD)
Kentucky Community and Technical College System & Lexington CC (KY)
Nashville Tech CC (TN)
Moraine Valley CC (IL)
Penn State University (PA)
U of Massachusetts Boston (MA)

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Information Technology
Space Technology
Sustainable Natural Resources
Chemical Process Technology
Information Technology
Environmental Technology
Non-Destructive Testing
Precision Agricultural
Microelectronics
High Performance Computing
Engineering Technology
Marine Technology
Biotechnology
Manufacturing
Engineering Technology
Telecommunications

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Information Technology
Manufacturing
Manufacturing
Information Technology
Information Technology
Information Assurance
Nanofabrication Manufacturing
Information Technology

Website

<http://acs.org/vis>
<http://www.nwcet.org>
<http://www.spacetec.org>
<http://www.ncsr.org>
<http://www.captech.org>
<http://www.itecfl.com>
<http://www.ateec.org>
<http://www.cnde.iastate.edu>
<http://www.agknow.org>
<http://matec.org>
<http://highperformancecomputing.org>
<http://www.njcate.org>
<http://www.marinetech.org>
<http://www.bio-link.org>
<http://www.aimcenter.org>
<http://scate.org>
<http://www.nctt.org>

Website

<http://www.midwestcenterforIT.com>
<http://www.create-california.org>
<http://www.ccbcnd.edu/sait2>
<http://www.kitcenter.org>

<http://www.cite-tn.org>
<http://cssia.org>
<http://www.nanofab.psu.edu/ATE>
<http://www.ccde.umb.edu/batec>

For more information on the ATE program, please see:

National Science Foundation

www.nsf.gov/ate

American Association of Community Colleges

www.aacc.nche.edu/ateprogram



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The American Association of Community Colleges (AACC) is the primary advocacy organization for the nation's community colleges. The association represents 1,100 two-year, associate degree-granting institutions and some 10 million students. AACC provides leadership and service in five key areas: policy initiatives, advocacy, research, education services, and coordination/networking.